Chapter 25
Open Burn/Open Detonation

25-1. General.

The process, applications, and possible toxic effects of open burn/detonation are described in the chapter's first section. The second portion of the chapter is a hazard analysis with controls and control points listed.

25-2. Technology Description.

a. Process.

Explosives may be encountered as a part of remedial actions, particularly at military and industrial sites. In many circumstances, the safest or only method for the safe disposal of these materials is by burning or detonation in open pits.

Open burning/detonation uses an excavated and usually bermed burn/detonation pit in which explosives of various classes can be burned and/or detonated. The pit, usually excavated to a depth of 6 to 10 feet, is typically ramped on one side to permit entry. Berms provide added containment while burning or detonating. The material for burning (including burnable explosives) or detonation is pumped or placed into the pit. Then material is ignited or detonated from a distance by electrical or ignitable fuses and/or detonators, signal fuses, torch, or other ignition/initiator sources. Good safety practices dictate electrical ignition whenever possible. In the case of burning explosives, an accelerant fuel, such as gasoline or other readily flammable material, may be poured onto the explosives to easily initiate the burn. Also included for detonations may be a primary explosive to make the explosion more efficient and complete. The contents of the pit are allowed to burn in the confined space until the burning/detonation is complete. See Figure 25-1 for an illustration of the process in simple form.

The pit may be emptied of residue between burnings/detonations or after a sequence of burnings/detonations has been performed. Burning or detonating batches of material in sequence can be highly dangerous since the operator must be certain that all burning/detonation is complete, and no premature ignition sources remain in the pit during reloading of the flammable/explosive wastes.

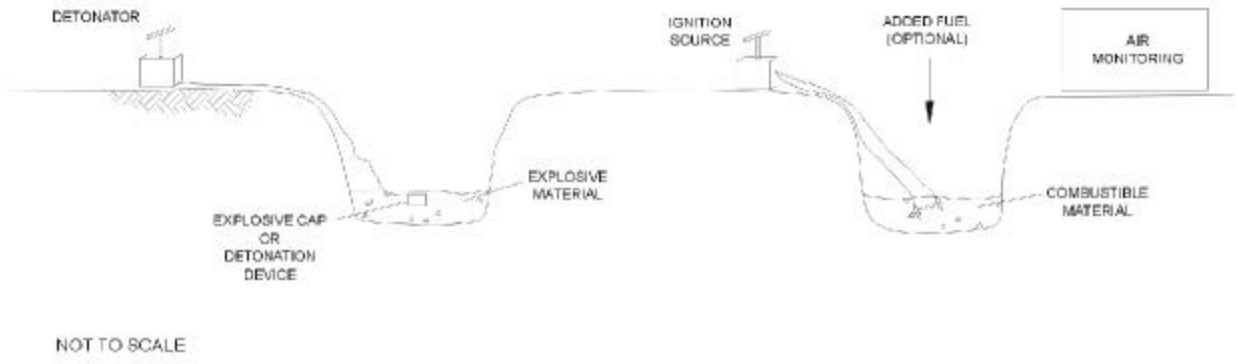

FIGURE 25-1. OPEN BURN/OPEN DETONATION

The operator needs a complete understanding of the age, state, and nature of the explosives or other materials to be destroyed, as well as other chemicals present. Many explosive material properties are radically different when burned or detonated in large masses versus small (e.g., large, burning masses of TNT may self-detonate while small amounts burn safely). An operator should be able to recognize certain metals, oxidizers, or reducers; know when material is partially melted; recognize aged or partially decomposed substances (e.g., picric acid); or a variety of other conditions.

b. Applications.

Explosives include propellants; high and low explosives, many of which will burn and/or explode; various initiators, ignitors, detonators, and accelerants. Included in these categories are dynamite, nitroglycerin, HMX, RDX, TNT, PETN, and Tetryl; mercury and other metal fulminates; styphnates; lead and other metal azides; ammonium nitrate; black powder; picric acid; and derivatives (such as salts) of the above.

c. Toxic Effects.

Most explosives such as TNT, RDX, picrates, HMX, tetryl, dynamite, and lead azides can have toxic effects or produce materials with toxic effects when burned or exploded. Examples of materials released or produced include unreacted explosives such as nitroglycerin and TNT, heavy metals such as lead or silver, salt products, nitrogen oxide, and other nitrogenous residues with potential toxicity.

25-3. Hazard Analysis.

Principal unique hazards associated with open burn/open detonation, methods for control, and control points are described below.

a. Physical Hazards.

(1) Ignition Systems.
Description: Burning ignition systems may not reliably ignite the waste material. The wick or flame used to ignite the waste material may be temporarily extinguished by moisture or wind, only to reignite shortly thereafter. The delay in ignition may cause workers to believe the burning ignition system has failed. As they approach the burn area to investigate, detonation may occur.

Control: Controls for ignition systems include
- Provide proper training and experience for personnel. This is critical.
- Design and construct reliable, remote, intrinsically safe ignition systems as a requirement for operation.

CONTROL POINT: Design, Construction, Operations, Maintenance

(2) Quantity, Type of Explosives.
Description: An explosion may damage the pit construction and injure any workers in the vicinity if more than the design quantity or type of explosives is detonated in one charge.

Control: Controls for quantity and type of explosives include
- Know quantities and types of explosives and never exceed limits.
- Follow control procedures rigorously.
- Evenly distribute explosive wastes. Uneven distribution can create an excessive density of explosive material, resulting in explosive conditions.

CONTROL POINT: Operations

(3) Pit Entry.
Description: Sharp and hot fragments and residue may be present when entering the pit after prior burns or detonations. Workers may also be exposed to potential wall collapse or confined-space entry hazards.

Control: Controls for pit entry include
- Wear appropriate personal protective equipment (PPE).
- Shore walls to prevent collapse.
- Require a structural inspection by a competent person prior to each pit entry.

CONTROL POINT: Design, Construction, Operations

(4) Handling Waste Materials.
Description: Hazards inherent in open burn and open detonation techniques may involve the handling of unstable waste materials, such as unusable munitions and explosive materials. Workers handling these materials face the risk of these materials auto detonating, especially if the explosives have become unstable due to age or other factors.

Control: Controls for handling waste materials include
- Use only persons specifically trained in detonation and disposal techniques to transport and handle materials.
- Consult the Ordnance and Explosive Waste (OE) Center of Expertise (CX), Huntsville, Alabama, prior to any handling or movement of explosive items or of soils/materials significantly contaminated with explosives.

CONTROL POINT: Operations

(5) Structures at or Near Detonation.
Description: One or repeated explosions may cause fragmentation of concrete or cinder block walls of buildings or structures at or near the detonation area, particularly if large quantities of explosive materials are detonated.

Control: Controls for damage to structures nearby include
- Limit the amount of waste materials detonated at any one time based on the known effects of the explosives.
- Divide large volumes of wastes and detonate in a series of smaller explosions.
- Locate the treatment facility carefully so that sensitive structures are not present or nearby.
- Design structures for shelter or containment of the explosions or burnings to adequately withstand the expected use of the system.

CONTROL POINT: Design, Operations

(6) UV Radiation.
Description: During site activities, workers may be exposed to direct and indirect sunlight and the corresponding ultraviolet (UV) radiation. Even short-term exposure to sunlight can cause burns and dermal damage. Hot and humid conditions may also result in heat stress, which can manifest itself as heat exhaustion and heat stroke.

Control: Controls for UV radiation include
- Minimize direct sun exposure by wearing sun hats, long-sleeved shirts, full-length pants, and by applying UV barrier sunscreen.
- Shade work and break areas, if possible.

- Minimize exposure to heat stress conditions by taking frequent breaks, drinking adequate fluids, and performing work during the early morning and late afternoon hours.

CONTROL POINT: Construction, Operations

(7) Predesign Field Activities.
Description: Predesign field activities associated with subsequent construction activities may include surveying, biological surveys, geophysical surveys, trenching, stockpiling, contaminant groundwater sampling, and other activities. Each of these field activities may expose the survey personnel to physical, chemical, biological, or radiological hazards.

Control: Controls for hazards resulting from predesign field activities include
- Prepare an activity hazard analysis for predesign field survey activities. EM 385-1-1, Section 1.A provides guidance on developing an activity hazard analysis.
- Train workers in hazards identified.

CONTROL POINT: Design

b. Chemical Hazards.

(1) Residual or Untreated Material.
Description: If detonation or burning fails to fully neutralize the material, workers entering the burn pit may be exposed to the material. Unreacted material may be carried downwind, exposing workers in the area. Heavy metal primer materials (metal azides and silver compounds) and residual explosive components (e.g., nitroglycerin) may cause heart arrhythmias, headaches, and other physical effects.

Control: Controls for residual or untreated material include
- Remain upwind of the pit during burning and detonations.
- Use PPE as determined by a qualified health and safety professional to enter the pit after burning and explosions. Examples of appropriate PPE include steel shank boots, coveralls to protect from dermal contact, nitrile or butyl gloves if soil handling is expected, and an appropriate air-purifying respirator if fumes or smoke are present.
- Use expertise in detonations and burning, including accelerants or fuels or initiator explosives, to assure the maximum explosive/waste consumption.

CONTROL POINT: Design, Operations

(2) Pit Atmospheric Conditions.
Description: Workers who enter the pit may be exposed to an oxygen deficient atmosphere or to airborne toxic materials.

Control: Controls for pit atmospheric conditions include

- Test the atmosphere within the trench to determine the level of airborne contaminants and the oxygen level prior to entry (see 29 CFR 1910.146).
- Follow confined-space entry protocols, which may necessitate the use of PPE such as an air-purifying respirator equipped with an organic vapor cartridge or a supplied-air respirator.

CONTROL POINT: Operations, Maintenance

c. Radiological Hazards.

No unique hazards are identified.

d. Biological Hazards.

No unique hazards are identified.